(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 515 864 A1**

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: **92107415.9**

(51) Int. Cl.[5]: **A23G 1/00**, A23G 3/00

(22) Date of filing: **30.04.92**

(30) Priority: **01.05.91 US 694099**

(43) Date of publication of application:
02.12.92 Bulletin 92/49

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

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(54) **Use of hydrocolloids for formulating and processing of low fat low water activity confectionery products and process.**

(57) A low or no fat confection is prepared containing 80% soluble solids wherein at least 70% of the solids are carbohydrates. The mixture containing carbohydrate, a cationic reactive and thermalsensitive hydrocolloid and an edible cation containing material is cooked or its solids concentration adjusted to 80% solids while hot. The molten mixture is then cooled to form a solid confection having a water activity being 0.30 to 0.65 Aw and a pH from 3.0 to 8.5.

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This invention relates to low or no fat confectionery and more Particularly to such confectionery items having reduced water activity, an acid to neutral pH, good flavor and texture. The invention is Particularly suitable for Preparing low fat or no fat confections such as caramel.

It is desirable to reduce the fat content of foods and to extend shelf life while retaining the full taste and texture thereof. Chocolate confectionery products often contain 20% or more fat while caramel and fruit flavored confectioneries often contain 10% or more fat. Shelf life of such products can be increased by increasing the soluble solids content of the food thus lowering the water activity (Aw) of the food. Numerous high sugar products have been formulated often including monosaccharides and polyols to reduce the water availability in the food to microorganisms.

However, these products often suffer from flavor and texture problems. Polyhydric alcohols contribute undesirable tastes to the confection but are needed to suppress water activity. Often the sugar content produces excess sweetness, thickness, and rigidity to the product. A high level of fat in confectionery products in addition to being of concern to many diet conscious consumers also results in products having poor shelf stability. However, the fat content of confectionery products is often maintained at a high level because it imparts lubrication for machining and cutting during candy manufacture, provides excellent mouth feel, flavor and stand up body. In addition, when emulsified, fat tends to inhibit crystallization and fat also imparts a sense of satiety after the product has been consumed.

A caramel composition of good flavor and soft texture is disclosed in US Patent 4,710,393 to Holmgren et al., issued Dec. 1, 1987 which employs a major amount of a blend of dextrose and fructose in the caramel and a moisture content of about 4% to about 10% which gives a water activity of 0.2 to about 0.5 Aw. In UK 1,538,750 to Jeffery, published Jan. 24, 1979, there is disclosed an over 20% fat containing chocolate product containing a gum (gelatin or gum arabic) which is employed to prevent fat separation from the product.

The hydrocolloids used herein are widely employed in foodstuffs including confectionery products and jellies. Gellan is used in fruit based bakery fillings, icings, frostings, glazes, jams and jellies. Carrageenan is widely used in milk and water desserts.

We have discovered fast setting, temperature resistant, acidic but particularly neutral pH confectionery products or items having good flavor and soft texture even though the fat content of these confectionery products or items has been substantially lowered or eliminated. We have modified the confection by reducing the fat content and by adding a hydrocolloid which forms a gel which has cation and temperature sensitive properties. We have further adjusted the total solids content of the confection from 80% or more solids. Carbohydrates comprise at least 70% of the total solids. In many cases we employ high fructose corn syrup, invert sugar or dry fructose so that the fructose concentration based on total solids is greater than 40%. For low calorie confectionery products or items, up to 40% of the carbohydrate can be low calorie bulking agents and at least 30% of the carbohydrate can be monosacharides. This adjustment of carbohydrate concentration and the type of material employed provides a confection having the desired calorie content and a water activity below 0.65 Aw.

We prepare a confection having a total solid content of 80% or more, preferably from 80% to 90% total solids and most preferably from 84° to 89° brix or percent solids. The carbohydrate content of the total solids is at least 70% of the solids. The carbohydrates can be mono, di and poly saccharides, sugar alcohols, cellulose and cellulose derivatives and extracts, gums and the like. In making good tasting low calorie confectionery products or items, we can employ up to 40% preferably 10-40% of the carbohydrate content of low calorie bulking agents such as polydextrose, sugar alcohols, cellulose, cellulose derivatives and extracts and gums with at least 30% of the carbohydrate content being monosaccharides. Where calorie reduction is accomplished using fat reduction primarily, we can employ mono and disaccharides with fructose being at least 30% of the carbohydrate content.

The particular carbohydrates employed can be any combination that meets the caloric target and water activity of 0.30 to 0.65 Aw and does not cause crystallization in the final product.

When using monosaccharides, fructose is employed for its sweetness and Aw lowering with the balance of the sugar solids usually dextrose. We use high fructose corn syrup of 55% or 90% fructose content or invert sugar which is commercially available to adjust the fructose concentrations. 100% crystalline fructose can also be used. Suitable sugars include sucrose, maltose, lactose and the like can be employed as part of our sugar solids although we prefer to employ fructose and dextrose. Suitable monosaccharides include fructose, dextrose and various high conversion corn syrups. Suitable disaccharides include sucrose.

The low calorie bulking agents include suitable polysaccharides including polydextrose sugar alcohols such as sorbitol, manitol, xylitol and the like, cellulose such as "Avicel" and other commercially refined edible products, cellulose derivatives and extracts such as carboxymethyl cellulose, methyl cellulose, hydroxy propyl methyl cellulose hydroxypropyl cellulose and mixtures thereof, Solka-floc, Curdlan, Oattrim,

Fibersol #2, Fibercel and the like, and gums such as xanthan, guar, pectin, locust bean gum, alginates, agar-agar, carrageenans, gum acacia, tara gum, karaya gum, furcelleran, traganth, ghatti and the like.

When using cellulose, we prefer to employ from 1-10% and more preferably 1-5% as a means of reducing calories but also for its fat mimetic properties when employed at small particle sizes of 0.1 to 20 microns, preferably 0.1-3 microns. In fact any finely derived insoluble carbohydrate or protein of 0.1-20 microns preferably 0.1-3 microns can also be employed at up to 40% of the solids content of the confectionery for its fat mimetic properties.

Up to 10% of the carbohydrate content of the confectionery product can be substituted for by protein. Proteins can be of an acceptable food source and can be unmodified or modified through the use of processing, enzymes or food grade chemicals. Particular proteins include zein, caseins, egg albumin, whey proteins, soy protein isolates, hydrolyzed proteins and the like.

We use a hydrocolloid which is both cationic reactive and thermosensitive; that is the hydrocolloid forms a gel which has cation and temperature sensitive properties. These cationic reactive thermosensitive hydrocolloids include linear, high molecular weight polysaccharides particularly the anionic variety such as carrageenan, furcellarin, gellan and the like. These materials are capable of being dispersed and hydrated in hot 80% soluble solids confectionery products or items having acidic or neutral pH ranging from pH 3.0 to 8.5. Acid confectionery products or items would be the fruit flavor variety. We prefer to make neutral products such as caramels and chocolates having pH from 5.5 to 8.5. The thermosensitive hydrocolloid on cooling solidifies. By using the linear, high molecular weight polysaccharides such as gellan and carrageenan, we are able to form gels with an appropriate cation containing edible material which on cooling set or gel into the desired high solids confectionery texture. It is the cationic reactiveness and thermosensitivity of our hydrocolloid gels which develop the desired confectionery texture when employed at 80% or greater soluble solids content and fat contents below 7%. The hydrocolloid used in this invention is also set or solidified in less than 30 minutes preferably in 20 minutes or less and often almost instantaneously as with carrageenan, when the high solids confectionery temperature is lowered.

Suitable hydrocolloids include the various carrageenans such as kappa carrageenan, iota carrageenan and lamda carrageenan and mixtures thereof, mixtures of carrageenan and locust bean gum, furcellarin and gellan. From 0.25% to 3.5%, preferably 0.4% to 0.8% by weight of the carrageenans both kappa and iota and mixtures thereof are employed with a suitable cation containing edible material such as milk solids, cocoa, potassium or calcium salts or other cation source. From 0.5% to 5%, preferably 0.75% to 3% by weight gellan is employed with from 0.1% to 0.5% citrate or other organic acid salt.

Gellan is useful for its brittle gel, clean flavor release and is stable over a broad pH range while carrageenan is useful for its chewable gel texture and very quick setting properties. Carrageenan also offers a wide range of viscosity at various temperatures. The hydrocolloids used herein are heat dispersible and resulting gels may be pumpable and/or shear reversible. The gels immediately set or gel within 20 minutes below 180°F and can produce textures ranging from a very firm gel to a soft spreadable gel suitable for molding, enrobing or incorporating into a confection such as a multi-component candy bar. Suitable cationic reactive and thermosensitive hydrocolloids can be employed. The texture of the gel can be adjusted by changing the concentration of the hydrocolloid, by selection of the appropriate individual mixtures of hydrocolloid, by changing the concentration of the cation containing edible material or by using one or more cations in the formula, and by adjusting pH of the formula.

We believe we are the first to discover that high solids 80% or more confectionery products or items can be chemically set particularly at neutral pH of 5.5 to 8.5. Where desired, non-cationic reactive hydrocolloids may be employed in minor amount (less 30%) to further modify the texture of the confectionery.

The fat content of the confectionery can vary from 0-20% for chocolate products, and 0-7% for fruit flavored and caramel products. However, in most cases we prefer to employ less than 7% fat in our products. We employ those fats including oils normally employed in confectionery products or items such as milk fat, cocoa butter, hydrogenated vegetable oil and butter.

Minor additives are employed such as emulsifiers like lecithin, mono and diglycerides and polysorbates at a concentration of from 0% to 10%; salt at from 0% to 2.5%, flavors and colors. We also can employ normal texturizing agents combined with our confectionery such as nuts, nougats, marshmallow, chocolate bits, coconut and the like.

We may also employ crispy bakery products and cereals like rice, puffed cereal, cookies, crackers and the like. The Aw of our confection reduces transfer of moisture to the drier baked or cereal items. With little or no moisture transfer between the various components of the confection there is little or no change in the texture of any components of the confection. Aw control provides for chewy and crisp components in the confection having good texture for a long period of storage. There is also less tendency for the confection

to dry out during storage. The low water activity also reduces the ratio of formation of off colors and flavors, reduces undesired browning, nutrient degradation, rancidity of fats and enzymatic reactions.

The cation containing edible material can be dairy products or other conventional confectionery ingredients which contain sufficient cations to react with the anionic polysaccharide and form a gel. Cation containing edible material include from 5% to 15% milk solids, 0 to 10% cocoa, 0 to 30% fruit juice, 0 to 20% fruit solids or any food grade potassium or calcium salts such as potassium chloride, calcium lactate, calcium chloride or the like at 0-5% concentration preferably less than 2.5%.

The confectionery of this invention is stable because of its low fat content and high solid gel. Excellent chocolate and caramel low fat, neutral pH, fillings are possible for use in candy bars or per se.

The confection of this invention can be prepared in a number of ways. A concentrated solution of gelling agent and water can be prepared at a temperature high enough to prevent gelling. The gelling solution can be added into a hot mixture (180 ° F) of the remaining ingredients with through mixing, often cooked to the desired solids content and cooled in molds or slabs until set. Alternatively, a blend of liquified corn syrup and dry sugars can be prepared and heated to 140 ° F. The dry gelling agent and further sugar is blended into the hot corn syrup. This hot mixture is transferred to a blender and the other ingredients such as milk solid, cocoa, salt and fat are added. The resulting mixture may be cooked to adjust solids content if necessary and is cast in molds or as a slab and allowed to cool and set. Alternatively, the gelling agents can be dispersed in water or a low solid liquid dairy product such as evaporated skim milk using shear at room temperature. The remaining ingredients are mixed into the dispersion and the mixture cooked and evaporated to the desired solids and flavor. The cooked mixture can be poured into molds or slabs and allowed to cool until set.

In general the hydrocolloid is dispersed in a hot state and mixed with other ingredients including an edible cation source and the solids content adjusted by addition of solids or removal of water until the desired taste and solids content is reached. At that time the mixture is cast and cooled to form the finished confectionery.

The confectionery may be used with other food ingredients in making enrobed candy products such as chocolate, caramel or fruit flavored bars. For example a layer of a baked wafer of high solids, low sugar content in rectangular form may be covered with a layer of nougat or fruit jam, another baked wafer, a caramel layer using the product of this invention, nuts mixed in the caramel or as a separate layer and a final baked wafer. The layered food is then enrobed with chocolate. The caramel or chocolate of this invention may comprise from 15-70% and preferably 20-50% of the bar.

The confectionery may also be shaped to make conventional caramel products and other attractive candies.

EXAMPLE 1

A typical caramel product is prepared from the following ingredients:

Ingredient	Chocolate, Caramel %	Regular Caramel %
Non-fat milk solids	7.1 (5-10%)	7.5 (5-10%)
High fructose corn syrup (23% H_2O; 55% fructose)	58.0 (28%-70%)	58.0 (28%-70%)
Carrageenan	0.4 (.25-2.5%)	0.45 (.25-2.5%)
Salt	0.35	0.35
Cocoa	4.0 (2.0-7%)	0
Water	27.65 (0-45%)	31.2 (0-45%)
Fat (butter)	2.0 (0-6.9%)	2.0 (0-6.9%)
Emulsifier	0.5 (0-10%)	0.5 (0-10%)
Total	100.00	100.00

The carrageenan is hydrated and dispersed in a solution of the non-fat milk solids and water using vigorous agitation at room temperature. The remaining ingredients are added and the mixture heated to cook and evaporate water until a solids content of 85% is reached at a temperature of 242 ° F. The hot mixture is then combined with other ingredients and cooled to form a confectionery. The caramel is characterized by a desirable chewy texture, low water activity of 0.30 to 0.65 Aw, a solids content of at least 80 ° brix and a pH of 5.5 to 8.5.

The candy bar is prepared by baking high solids, low sugar wafers. A rectangular wafer is covered by a layer of nougat, another wafer, a layer of caramel prepared as in Example 1, a layer of ground nuts, and a

wafer. The entire layer mass is enrobed with chocolate to form a candy bar containing 20-35% caramel.

Peanuts are finely ground and mixed into the caramel of Example 1 to make a variant candy bar. The nougat can be replaced by fruit filling or jam. The wafers can be spiced and coated with white chocolate. Numerous variations are possible.

The carrageenan employed above can be replaced with 3% gellan (0.5 to 5%) with from 0.1-0.5% organic acid salt such as sodium citrate to give excellent products.

EXAMPLE 2

	%
HFCS 55%	34.3
Sucrose Solution 60%	16.0
Dextrose	48.25
Gellan	0.12
Calcium Lactate	1.33
	100.00

The high fructose corn syrup and sucrose solution were heated on a stove for three minutes. The gellan, calcium lactate and dextrose were added to the mixture and heated for three minutes on high heat. The mixture (83% solids) was poured into a petri dish and placed on ice to cool. The cooled confectionery kept its shape better than a control made without gellan or calcium source.

Higher levels of gellan would produce firmer gels.

EXAMPLE 3

A stock solution was prepared of 4 parts gellan, 95.7 parts water and 0.3 parts by weight sodium citrate. The solution was heated to boiling to hydrate the gellan and held at 180-190°F. 100 grams of the solution were combined with 400 grams of 79% fructose solution mixed well and the mixture cooled. The solution 85 brix, pH 5.15 containing about 0.8% gellan slowly solidified into a smooth, hard to cut gel.

When 2 millimolar calcium chloride was added with the fructose there was some pregelling. On cooling the 86° brix pH 4.54, approximately 0.4% gellan (50 g 4% solution added to 450 g 79% fructose) mixture there was obtained a grainy, very strong, clear, orange gel.

EXAMPLE 4

100 grams of a 4% gellan solution was mixed with 400 grams of Lycasin (75° brix).

250 grams of the mixture was heated to boiling and cooked to 81° brix and combined with 2 millimolar calcium chloride to give a grainy, slightly yellow, very hard, clear gel on cooling. Some pregelling was noted.

EXAMPLE 5

	Caramel %
Corn Syrup	20.37
Invert or HFCS	33.35
Sweet Condensed Whole Milk	31.57
Margarine	2.73
Vegetable fat flakes	5.70
Lecithin	0.12
Sugar	5.14
Salt	0.24
Gellan	0.75
Sodium citrate	0.30
	100.00

Dry blend the gellan and sugar. Add that mixture to the corn syrup and milk. Next add lecithin and the vegetable fat. Cook to about 254° F. The final cooked material, 83° brix, pH 5.95 gelled to a good texture on cooling. The confectionery was useful for enrobing and attachment of food particles. For example, an apple was dipped into the caramel which was then rolled in nuts which adhered to the caramel coating to make a tasty caramel candied apple.

EXAMPLE 6

	%
Corn Syrup (42DE)	10.37
Invert Sugar	43.30
Condensed Milk	33.35
Butter	2.73
Fat-flakes (Paramont brand)	5.70
Lecithin	0.12
Sugar	5.14
Salt	0.24
Gellan	0.75
Sodium citrate	0.30
	100.00

Heat the corn syrup, invert sugar, and condensed milk to 140° F. Add the dry ingredients as a blend and heat to boiling. Add the fat flakes and lecithin and boil for one minute. Add the butter and boil for one minute. The mixture (86° brix, pH 5.86) was cooled to form a good gel with a shorter slight sticky texture and a good color.

EXAMPLE 7

"No" Fat Caramel	
	%
Evaporated Skim Milk	36.55
Disodium phosphate	0.06
High fructose corn syrup (55% fructose)	61.04
Avicel cellulose	1.0
Iota-kappa blend of carrageenan)	0.2
Butter Flavor	0.15
Salt	0.5
Lecithin	0.2
Atmul	0.3
	100.00

Disperse the cellulose in corn syrup (adjusted to pH 7.06). Hydrate the carrageenan in milk. Mix the corn syrup and milk mixtures together and blend in the cocoa using a blender by adding in small amounts. Heat to boiling in a steam kettle. Add butter, lecithin and Atmul to the boiling mixture. Cook until 245.5° F, 87% solids.

Residual fat in the skim milk, butter base, lecithin and Atmul resulted in 0.7% fat in the 57% solids mixture.

The product was a very good "no" butter caramel. It is difficult to tell the differences between this product and a 10% fat containing caramel.

EXAMPLE 8

Chocolate Caramel	
	%
Evaporated skim milk	34.69
Disodium phosphate	.01
High fructose corn syrup	57.16
Butter	2.0
Cocoa	4.0
Avicel	1.0
Water	0.3
Viscarin GP 328 carrageenan	0.35
Lecithin	0.19
Atmul (emulsifier)	0.3
	100.00

Disperse the Avicel in the corn syrup and disperse and hydrate carrageenan in the milk. Add the mixtures together. Next dissolve disodium phosphate in water and add to the dispersion. Blend in cocoa solids to the dispersion and add lecithin and atmul. Heat the mixture to 110° F to melt the lecithin and atmul. Cook mixture to 245° F, 87.85% solids, water activity 0.49.

EXAMPLE 9

	%
Evaporated skim milk	34.86
Disodium phosphate	0.01
High fructose Corn Syrup	58.24
Butter	4.0
Avicel	1.0
Water	0.3
Kappa-iota carrageenan blend	0.6
Salt	0.5
Lecithin	0.19
Atmul (emulsifier)	0.3

Cook in a kettle as previously to 89.3% solids, 5.7% fat. The hot mix is very fast gelling (less than 1 minute) and was molded into the shape of bears and beans.

Chocolate and lemon bars were made following the layering procedure set forth in Example 1.

While we have described our confection in terms of caramel and chocolate caramel, the advantages of this invention can be applied to other normally fat containing confectionary material such as fudges, nougats, toffee, creams, gums, jellies and other water based confections.

Claims

1. A water and sugar based high solids confectionery having good flavor and texture comprising at least 80% total solids wherein the carbohydrate content is at least 70% of the total solids, a cationic reactive and thermosensitive hydrocolloid; a cation containing edible material; and up to 20% fat, said confectionery having a water activity below 0.65 Aw and a pH from 3.0 to 8.5.

2. The confectionary of Claim 1 which comprises up to 90% total solids and in which the carbohydrate is of mono, di and polysaccharides, sugar alcohols, cellulose, cellulose derivatives and extracts, gums or mixtures thereof.

3. The confectionary of Claim 1 or 2 in which the cation containing edible material is a dairy product, cocoa, fruit juice, fruit solids, edible potassium and calcium containing salts or mixtures thereof.

4. The confectionary of Claim 1, 2 or 3 wherein the fat content is below 7% and the hydrocolloid comprises an anionic, linear, high molecular weight polysaccaride, the pH is from 5.5 to 8.5 and the water activity is 0.30 to 0.65 Aw.

5. The confectionary of any one of Claims 1 to 4 in which the hydrocolloid is carrageenan, gellan gum or mixtures thereof.

6. A low calorie and low confectionery according to any of Claims 1 to 5 in which the carbohydrate comprises from 10 to 40% low calorie bulking agent and less than 5% fat.

7. A low calorie and low fat confectionary of any one of Claims 1 to 6 in which the carbohydrate comprises up to 40% low calorie bulking agent selected from polydextrose, sugar alcohols, cellulose, cellulose derivatives, extracts or gums and at least 30% monosaccharides.

8. A low calorie and low fat confectionery of any one of Claims 1 to 7 in which the carbohydrate comprises at least 30% fructose.

9. A caramel confectionery of Claim 7 in which the cation containing material comprises dairy products or cocoa, the carbohydrates comprise at least 30% monosaccharide and the fat content is below 5%.

10. A method of preparing a low fat, high solids confection comprising:
    a) mixing and heating to an elevated temperature a cationic reactive and thermosensitive hydrocolloid and water to disperse the hydrocolloid;
    b) mixing the water hydrocolloid mixture with a cation containing edible material, carbohydrate and

less than 7% fat;
c) cooking or otherwise heat treating the mixture of
(b) to develop flavor and to reduce or adjust the solids content of the mixture to at least 80%; and
d) cooling the mixture to cause solidification of the mixture in less than 20 minutes to yield a softness, flavor and texture mimicking the full fat equivalent confection, said confectionery having a water activity below 0.65 Aw and a pH from 3.0 to 8.5.

11. The method of Claim 10 in which the hydrocolloid is selected from gellan, carrageenan or mixtures thereof; the cation containing edible material is selected from dairy products, cocoa, fruit juice, fruit solids, edible potassium or calcium containing salts or mixtures thereof; the fat content is less than 5% and the pH is from 5.5 to 8.5.

12. The method of Claim 11 or 12 in which the confectionery contains cocoa or dairy solids, 0% to 4% fat and the hydrocolloid is carrageenan or gellan gum.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 10 7415

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 273 001 (WARNER-LAMBERT CO) * example 1; claims 1-16 *	1,2,4,5,7	A 23 G 1/00 A 23 G 3/00
A	EP-A-0 285 187 (PROCTER & GAMBLE CO) * page 4, claims 1-9 *	1-3,7	
A	DE-A-2 912 411 (A. STORCK K.G.) * claims 1-4 *	1,2,4,5	
D,A	GB-A-1 538 750 (CADBURY LTD) * claims 1-12 *	1-3,10-12	
D,A	US-A-4 710 393 (M.E. HOLMGREN et al.) * abstract; claims 1,2 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A 23 G 1/00
A 23 G 3/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	04-08-1992	SCHULTZE D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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